

## Model Answers: Basics of Logic

Basics of Logic  
Study guide



1.

- a) Proposition.
- b) Question and therefore not a proposition.
- c) Proposition.
- d) Instruction and therefore not a proposition.
- e) Proposition albeit a contradiction.
- f) Proposition.
- g) Proposition albeit false.
- h) Proposition albeit false.

2.

- a) "He does not wear shoes or he wears shoes."
- b) "He does not not wear shoes."
- c) "He does not wear shoes or he wears socks."
- d) "If he wears shoes he wears socks."
- e) "If he wears shoes he wears socks and if he wears socks he wears shoes,"  
or "He wears shoes if and only if he wears socks."
- f) "If he wears shoes then, he wears shoes or he wears socks."

a)

$p$	$\bar{p}$	$\bar{p} \vee p$
T	F	T
F	T	T

This is a tautology as the final column contains only T.

b)

$p$	$\bar{p}$	$\bar{\bar{p}}$
T	F	T
F	T	F

c)

$p$	$q$	$\bar{p}$	$\bar{p} \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

d)

$p$	$q$	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Note that this is the same as c) because  $\bar{p} \vee q \equiv p \rightarrow q$ .

e)

$p$	$q$	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

f)

$p$	$q$	$p \vee q$	$p \rightarrow (p \vee q)$
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	T

This is a tautology as the final column contains only T.

3.

a)  $q \wedge \bar{q}$

This is a contradiction as it is always false.

b)  $\overline{p \vee q}$

c)  $p \leftrightarrow p$

This is a tautology as it is always true.

d)  $q \rightarrow \overline{p \vee q}$  or  $q \rightarrow (\bar{p} \wedge \bar{q})$

This is a contradiction as it is always false.

e)  $(q \rightarrow p) \wedge (p \rightarrow q)$

f)  $\bar{p} \wedge \bar{q}$

g)  $p \leftrightarrow q$

The expressions b) and f) are logically equivalent.

The expressions e) and g) are logically equivalent.

The expressions a) and d) are logically equivalent because all contradictions are logically equivalent.

You could check these by using truth tables.



These model answers are one of a series on mathematics produced by the Learning Enhancement Team.

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